



Technology News

November 2002

◇ *USDA Natural Resources Conservation Service* ◇ *Science and Technology* ◇

“NRCS *Technology News*” is an electronic information piece provided by Science and Technology 10 times a year. It is designed to deliver pertinent information to our customers about new technology, products, and services available from the Soil Survey and Resource Assessment and the Science and Technology deputy areas. “NRCS *Technology News*” is in a format that is available to all NRCS field staff.

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● MESSAGE FROM THE DEPUTY CHIEFS

Lawrence E. Clark and Maurice J. Mausbach

Often we become so involved with science and technology within the boundaries of our jobs that we may forget the contexts within which we do our work. Those things that are important to our clientele—the ability to make a living, good markets, healthful living conditions, safe and secure environments for our children and ourselves, and knowledge to make good, sustainable decisions—are important to all peoples of the world. This was vividly brought to center stage during the World Summit on Sustainable Development that was held recently in Johannesburg, South Africa. Larry Clark and Marc Safley had the privilege of participating as members of the United States Delegation and representing NRCS and our Science and Technology Consortium at that world forum.

What is the status of our world, its resources and its people? The following facts, discussed at the Summit, provide some measure of it: (1) World population passed 6 billion in 2000 and is projected to grow to 8 billion by 2025. Most of this growth will occur in developing countries. By 2050, population is projected to top out at about 11 billion. Increased population and demand for higher standards of living will mean unheard of stress on natural resources. (2) AIDS is undermining sustainable development—especially in sub-Saharan Africa where it is the leading cause of death, reducing life expectancy to an average 47 years. (3) In the 1990s, the poverty rate in developing countries, based on an income threshold of \$1 per day, declined from 29 percent to 23 percent. By this criterion, about 1.2 billion people are living in poverty today. Rural Asia and sub-Saharan Africa have the highest poverty rates. (4) Almost 800 million people in developing countries are chronically undernourished, a significant reduction from over 950 million in 1970. Nearly one-third of the world's population suffers malnutrition of one form or another. Trends indicate that East Asia and Latin America are on track to meet the United Nations' Millennium Declaration goal of halving by 2015 the proportion of people who suffer from hunger. (5) From 1970 to 1999 average food consumption per person increased in all regions. (6) The potential to expand crop production is limited. At present, about 11 percent of the world's land

surface is used for crop production (cultivated crops and permanent crops). In Latin America and sub-Saharan Africa there is still potential for limited expansion of agricultural land as well as for increased productivity. (7) In balance to the previous point, the greatest threat to forests, wetlands, mountain systems, and biodiversity worldwide continues to be expansion of agricultural land due to increased food demand and loss of arable land due to misuse and abuse. (8) Agriculture dominates global water use. Agricultural water use represents about 70 percent of total water withdrawals and about 90 percent of water actually consumed for human purposes. Water use has increased six-fold over the last century, more than twice the rate of population increase. (9) Worldwide, about half of all wetlands have been lost and more than 20 percent of the world's known 10,000 freshwater species are extinct, threatened, or endangered. (10) Over one billion people lack access to safe drinking water, and 2.5 billion lack adequate sanitation facilities. (11) Nearly half the world's population will experience water shortages by 2025. (12) World forested area declined by about 2.4 percent in the 1990s (about 21 million acres). The primary cause of this loss has been agricultural expansion and shifting cultivation patterns. (13) Energy consumption of all types is growing despite declines in Eastern Europe and the former Soviet Union. Low-income countries depend on biomass energy; however, this represents a health challenge for billions due to effects of chronic smoke inhalation. (14) People in developed countries consume up to 10 times more fossil fuel than people in developing countries. (15) Crop genetic diversity is a key factor in addressing long-term sustainable production and adaptation needed to meet changing environmental and pest conditions. For example, Mexican farmers today raise 20 percent of the corn varieties they cultivated in the 1950's. In the U.S., 95 percent of cabbage, 91 percent of field corn, 94 percent of pea, 86 percent of apple, and 81 percent of tomato varieties cultivated in the last century have been lost. Of the 7,100 varieties known to be in existence in 1800, only 1,000 are still alive today.

The Summit reaffirmed sustainable development as a central element of the international agenda and gave new impetus to global action to fight poverty and protect the environment. The understanding of sustainable development was broadened and strengthened, particularly concerning the important linkages among the factors of poverty, the environment, and the use of natural resources. Governments agreed to and reaffirmed a wide range of concrete commitments and targets for action to achieve more effective implementation of sustainable development objectives. Energy and sanitation issues were critical elements of the negotiations and outcomes—to a greater degree than in previous international meetings on sustainable development.

The Summit and its Plan of Implementation gave a large boost to the concept of partnerships between and among governments, business, and the public. Over 220 partnerships (with \$235 million in resources) were identified in advance of the Summit and about 60 partnerships were announced during the Summit by a variety of countries. The United States played a critical role by championing the concept of partnerships and working to make them a key Summit outcome.

What does this mean for NRCS and our science and technology? What is our role in this broader interaction? First, it means that our actions are not performed in only a U.S. context. What we do has broader application and meaning when shared in the global community. We shall be working to help further the partnerships entered into because of the Summit. Next, we have the opportunity to learn a broader set of technologies. Our clients benefit when we expand our learning of new concepts and applications that are shared with us. Finally, as our experience at the recent World Summit on Sustainable Development confirms, the work of NRCS and of Science and Technology embodies the concept of sustainable development. We provide science and technology that satisfies present needs without compromising the ability of future generations to meet their own needs, which is essential to our goal of sound resource management and good conservation both nationally and as a member of the global community.

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● CONSERVATIONIST'S CORNER

Judith Doerner, State Conservationist, Rhode Island

In the year 2000, Rhode Island NRCS received funding to develop a watershed plan for the Pocasset River Watershed located in the town of Johnston and city of Cranston. Rhode Island, having a small staff with limited watershed planning experience, needed assistance to complete development of the watershed plan. We enlisted the services of NRCS staff from New York, New Jersey, Maine, the Mid-Atlantic Interdisciplinary Resource Team (IRT), National Water Management Center (NWMC), and the National Design, Construction, and Soil Mechanics Center (NDCSMC).

Staff from the NWMC spent 5 days in Rhode Island touring the watershed and reviewing areas impacted by flooding in order to provide assistance in the development of a plan of work and an outline for the watershed plan and to develop preliminary alternatives to mitigate flooding. The NWMC will also conduct a peer review of the draft plan prior to public review.

The biologist and cultural resources specialist from the Mid-Atlantic IRT traveled to RI to review potential impacts of the proposed alternatives to cultural and environmental resources, and begin the National Environmental Policy Act (NEPA) required scoping meetings with U.S. Fish and Wildlife, Environmental Protection Agency, and the Army Corps of Engineers. Recommendations provided by the IRT staff were incorporated into the plan of work.

Data gathering for the study made use of many technological resources. To define the flood plain the Federal Emergency Management Agency's National Flood Insurance flood maps in digital form were overlaid onto 1997 aerial photographs and used as field sheets. Using Global Position Satellite (GPS) units and other state-of-the-art equipment, RI's engineering staff surveyed and collected valuable information on all structures within the flood zones, including elevation of the ground, first floor, and low opening.

Each structure was identified with a unique label on the field sheet, which also served as its photo or digital image identification. Additional economic related information about each structure was recorded in a field book.

To facilitate the handling of the vast array of survey data for the study, ArcView Geographic Information System (GIS) software was used to compile many sources of data into one database. Using 1997 digital orthophotography as the base, an ArcView theme was created identifying each surveyed structure. Point data were digitized on-screen to replicate the field sheets and were joined to the Excel database using the unique label. A *hotlink* was established for each point linking the digital imagery of the structure to that point in the theme. Roads, floodplains, soils, wetlands, and other data available through the Rhode Island GIS were also displayed over the base photography for quality control.

To link the data needed for the economic analysis, tax assessors' databases were obtained from the city of Cranston and the town of Johnston. Using the street address as the common attribute, the assessors' data were joined into the ArcView theme. Quality control was essential.

Meanwhile, computer modeling and additional surveying were being conducted to refine the flood plain boundary for the 2, 10, and 100-year storms. AutoCAD data were exported to ArcView files so that they could be displayed over the base maps. Stormwater elevations in the floodplain were calculated and compared to the elevations of the structures to identify the properties that would be affected by these storm events. Maps of the refined floodplain boundary were printed for review at public information sessions along with maps showing the properties that would be affected by the 2, 10, and 100-year storms.

New York and Maine State Office staff members developed an extensive HEC-RAS (hydrology and hydraulics) model to be used to evaluate changes in flood stages for various planned flood reduction alternatives. It covers approximately 18 river miles, with approximately 1,200 cross-sections and 40 bridges. Staff of NDCSMC provided assistance in the construction and peer review of the model.

By making use of modern technology and taking advantage of the staffs from various NRCS technical centers, work on RI's Pocasset Watershed study is moving along on schedule. Use of these new tools and knowledgeable people will ensure a study that is complete, accurate, and which meets the expectations of the local sponsors. For further information, contact Joseph Bachand, Project Manager, at (401) 828-1300.

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● NEW PRODUCTS AND SERVICES

#1 Publication Explores Benefits of No-Till and Buffers in Midwest

“Economic Benefits with Environmental Protection: No-Till and Conservation Buffers in the Midwest” is a publication recently released by CTIC, the Conservation Technology Information Center. The document explores the challenges, opportunities, management tactics, and successful marketing efforts of promoting no-till and conservation buffers in the Great Lakes Watershed and North Central region.

NRCS staff helped produce the document and it contains numerous NRCS pictures. The Forward is by Bruce Knight, NRCS Chief. Electronic copies of the document and GIS maps are available at: <http://www.ctic.purdue.edu/ctic/FINAL.pdf>.

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#2 Social Sciences Institute's Conservation Buffers Report Available Online

The Social Sciences Institute (SSI) technical report, "Adoption of Conservation Buffers: Barriers and Strategies," is now available on SSI's Web site. This report examines attitudes and behaviors of four producer groups—all producers, livestock, low-income and minority, and American Indians—relative to the adoption and diffusion of conservation buffers. Barriers to the adoption of buffers and strategies/recommendations that address these barriers are listed for each group. The report includes a technology transfer model that illustrates methods for gathering information about the needs and preferences of producers for establishing and maintaining buffers.

An electronic version of the report is available for viewing and printing through SSI's Web site, <http://www.ssi.nrcs.usda.gov/ssi/>, under "What's New" and also "Technical Reports" (T 022).

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• TECHNOLOGICAL ADVANCES

#3 National Soil Survey Center Contributes to National Soil Phosphorus Project

As part of the National Soil Phosphorus (P) Project, soil scientists at the National Soil Survey Center (NSSC) developed several techniques/models. The NSSC is providing models and techniques development in addition to its support for the project's laboratory characterization of soils and methods evaluation. The National Soil P Project, a cooperative project of the Agricultural Research Service (ARS), Environmental Protection Agency, NRCS, and Land Grant Universities, is using field research and laboratory characterization of soils to build a database of the relationship between soil P levels and soluble P transport in runoff.

An innovative technique was developed to estimate P release characteristics and P runoff for agricultural land. The technique implements a new anion exchange resin (AER) method and uses the NRCS runoff model to quantify the environmental impact of agricultural land on water resources. Field studies using rainfall simulators to estimate P runoff are in progress by university partners and ARS on benchmark soils of the United States. Data from these runoff studies can be used to verify and calibrate the technique. A technical paper summarizing the AER methodology has been accepted for publication.

NSSC scientists have also proposed a broad-scale model—based on soil phosphorus, slope/hydrology, and annual precipitation—to evaluate and map phosphorus risk potential (PRP) for agricultural land. A case study was conducted in Lancaster County, Nebraska, by a project team that included soil scientists and associates from the NSSC, Nebraska State Office, and Lancaster County Nebraska Field Office. A technical report has been published, and copies were distributed to NRCS state offices and agricultural communities for comments.

Scientists at the Soil Survey Laboratory introduced a multi-element extraction technique for soils to simultaneously determine P, essential micro-nutrients, and macro-nutrients in addition to heavy metals. This multi-element extraction is attractive to scientists and soil testing laboratories because it eliminates the need for multiple extractions and allows simultaneous measurements of elements using the Inductively Coupled Plasma (ICP). The technique can be used for studies related to nutrient management practices, manure application on agricultural land, animal feedlots, and municipal/industrial waste management. A technical paper has been submitted for publication and a presentation is scheduled for the Annual Soil Science Society of America Meetings, Indianapolis, Indiana.

Science-based information developed as a result of this project will improve our understanding of P transport in agricultural production systems. It will also identify the soil P levels that can be successfully managed in production systems without unacceptable P transport and delivery into surface water bodies. NRCS is supporting field research being conducted by Colorado State University, Virginia Tech University, Iowa State University, and a preliminary project with the University of Puerto Rico.

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● TECHNOLOGY TRANSFER

#4 National Plant Data Center Active in Global Plant Science Developments

To continue the active contribution of the National Plant Data Center (NPDC) to global plant science, Scott Peterson, NPDC Director, recently participated in an international plant science conference in Brazil. The conference proceedings contributed to progress in the development of a scientifically credible checklist of the world's known species, establishment of international standards for taxonomic databases, and technology transfer among taxonomic projects globally. Worldwide knowledge of species and their distribution by nation will support conservation initiatives globally and assist the U.S. and other nations in addressing invasive species. Additionally, with all nations contributing to and using a scientifically credible list, all will be able to more easily communicate and exchange natural resource information.

Peterson's activities included meetings and workshops with the International Working Group on Taxonomic Databases—<http://www.tdwg.org/>, International Organization for Plant Information-Global Plant Checklist Committee—<http://www.iopi.org>, Global Biodiversity Information Facility-Catalogue of Life—<http://www.gbif.org/>, and Species 2000 <http://www.sp2000.org/>. He also met with representatives of the Botanisches Garten und Botanischer Museum-Berlin, with whom the NPDC is cooperating in the development of the next generation of taxonomic database software for PLANTS and the Berlin Botanical Museum.

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#5 Teachers' Online Resource Offers PLANTS Link

PLANTS is identified as a dependable resource for plant information in a classroom lesson plan for grades 3 through 12 at Education World, an online teachers' resource site. "Pair the Plants: An Introduction to Scientific Names," http://www.education-world.com/a_lesson/02/lp259-01.shtml, provides a link to PLANTS for teachers. The accompanying student activity sheet, which asks the student to match the common plant name on one list to its corresponding scientific name on a second list, identifies PLANTS as one of two resources most helpful for completing the exercise.

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• WEB-BASED TECHNOLOGY

#6 PLANTS Updates Threatened and Endangered Module

The PLANTS [T&E module](#) (threatened and endangered) now provides access to State, as well as Federal, protected plants, and in a new flexible search format. You can view any of the following kinds of T&E plant lists, each with names linked to Plant Profiles: (a) the Federal list, (b) the Federal list for one or more States, (c) a State list, (d) a State list for multiple States, and (e) a Federal and State combination list. Links are provided to State and Federal resource agencies with more information about laws and protection efforts. Use the new module to learn more about endangered flora or for help with conservation planning and research.

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#7 PLANTS Usage Up for FY 2002

The PLANTS Web site, <http://plants.usda.gov>—one of the three NRCS Strategic Databases—received over 50 million hits in FY 2002. This activity is up from 29.5 million hits in FY 2001. The average number of visitors per day was over 5,000. When you consider the average time that each visitor used the site, in FY 2002 PLANTS provided over 130 staff years of technical assistance to the field and the public.

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• TRAINING

#8 Air Quality Workshop Focuses on 2002 Farm Bill Opportunities

A National Air Quality Workshop will be held in St. Louis, Missouri, on November 5-7, 2002. Workshop information will help NRCS employees better understand air quality responsibility under the Energy Bill and how to implement the NRCS air resource portion of the 2002 Farm Bill. Information gathered from this workshop will be used to help develop National Policy and Technology Guidance. Those who should attend are State Conservationists and two or three employees in each State with responsibility for programs, conservation planning, and operations.

For more information on the conference, location, and registration, visit the Web site at www/wrev.nrcs.usda.gov/nrcs/airconf/.

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#9 *The Leader in You* Seminar Emphasizes Accelerating Leadership Development

According to NRCS Chief Bruce Knight, a significant challenge for NRCS “is to prepare for the upcoming loss of many of our older employees. You have all heard about the so-called retirement bulge, when thousands of our employees become eligible to retire.” (1) To help address these future staffing needs, the Social Sciences Institute and the National Employee Development Center, in cooperation with the National Association of Conservation Districts, National Association of State Conservation Agencies, and the National Conservation District Employees Association, are sponsoring a satellite seminar. “Leaders Who Teach: Accelerating the Leadership Pipeline” will be held on Thursday, November 14, from 1 to 3 p.m. Eastern Standard Time.

The objective of this seminar is to foster understanding of the relationship between a learning atmosphere and the development of leaders. Dr. Andrea Zintz will cover two main topics: the role of teaching in effective leadership and a leader’s use of communication techniques. The first half talks about recognizing the differences between mentoring and coaching, leveraging one’s point of view and experience, and discovering what makes “learning environments” succeed. The second half includes topics on how leadership/communication styles affect the work environment, the role of questions in generating learning, and how storytelling can be used as a teaching tool.

About the speaker:

Andrea Zintz has over 20 years of experience with Johnson and Johnson in the area of worldwide leadership development. She has served as Vice President, Human Resources, and as a member of the Management Board of one of their operating companies. Zintz’s personal consulting practice focuses on working with senior leaders of corporations to help them construct change strategies and human development systems to support and execute their business strategies. She has earned an M.A. and Ph.D. in Human and Organization Development.

1. “Civil Rights in the NRCS Workforce and Program Delivery.” Remarks by Bruce I. Knight, Chief Natural Resources Conservation Service at the NRCS All Special Emphasis Program Manager Training Conference, August 27, 2002.

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● MEETINGS/PRESENTATIONS

#10 Watershed Science Institute Presents WEND Models

The Watershed Science Institute presented the results of four Watershed Ecosystem Nutrient Dynamics (WEND) Models at the recent American Chemical Society National Meeting in Boston. The WEND models track phosphorus movement at a watershed scale and allow the user to examine different phosphorus management scenarios. The presentation included a comparison of the four models, which highlighted how phosphorus management strategies must be tailored to each watershed because of differences in phosphorus transport mechanisms and watershed characteristics.

The presentation can be viewed at:

http://www.wcc.nrcs.usda.gov/watershed/docs/Modeling_Phosphorus_Watershed_Scale.ppt

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